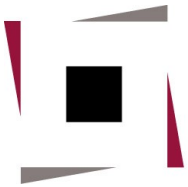

Dy 4 Systems
A FORCE COMPUTERS BUSINESS UNIT

Architectural Freedom with Serial Interconnects

NDIA Conference

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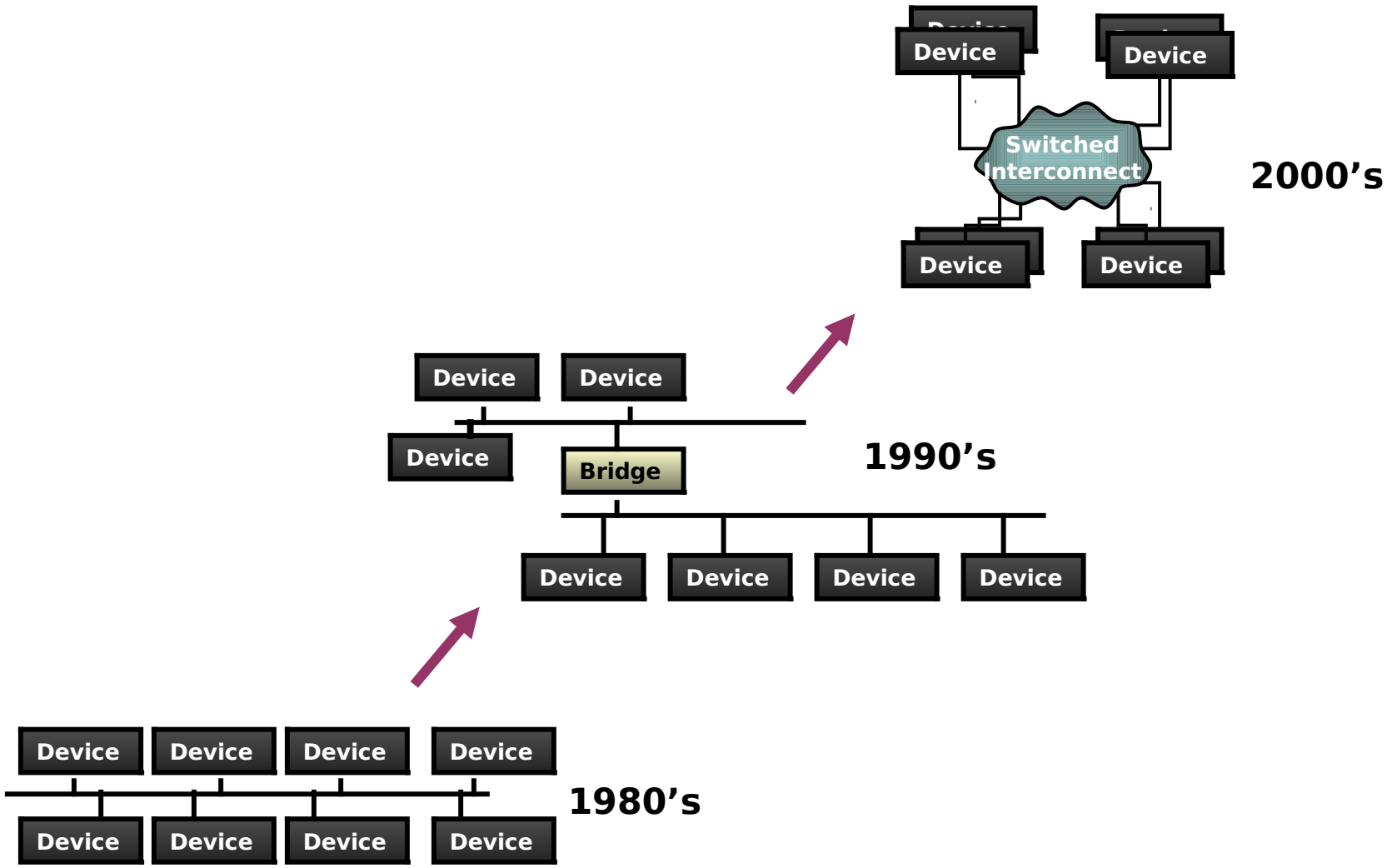
Interconnect Trends
Bus vs. Switched



Shortcomings of Parallel Buses

Buses Don’t:

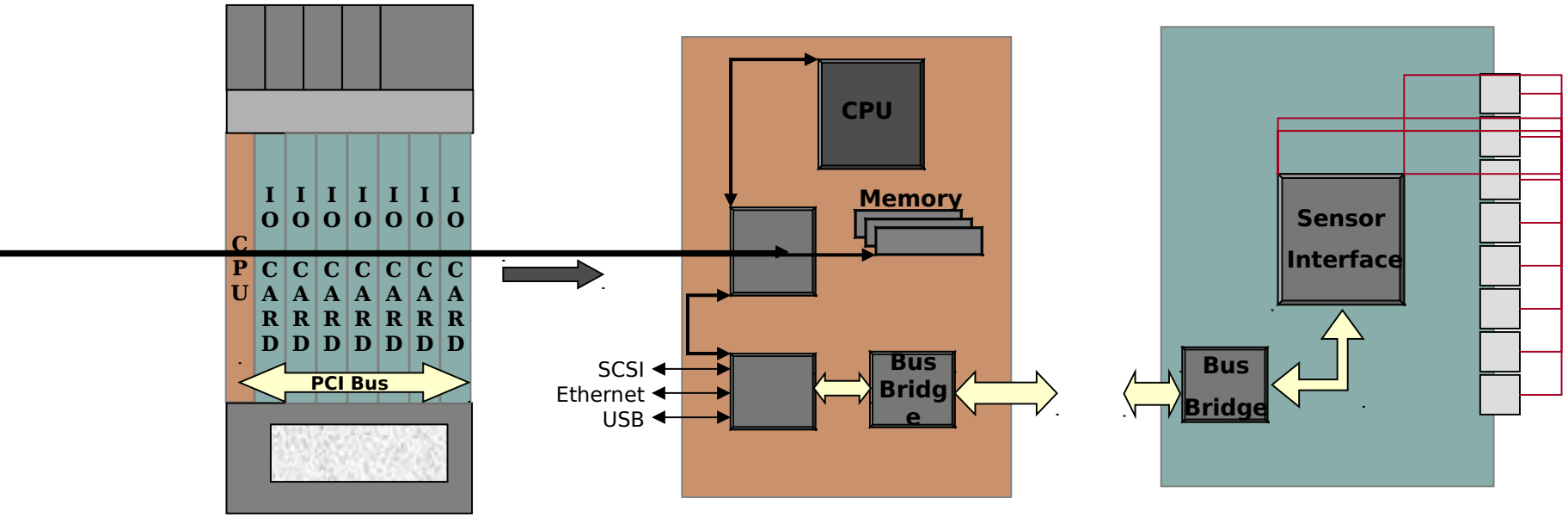
- **scale number of connections**
- **scale physically**
- **scale bandwidth**
- **support multiple traffic types**
- **support high availability**

You only need to encounter one limitation to make the move to a new architecture

Typical Embedded Distributed System Requirements

- **Large amount of data movement**
- **Large amount of data processing**
- **Large number of processing elements**
- **Often multiple processor types**
  - DSP, CPU and NPU
- **Wide range of I/O devices**
  - Sensors
  - Imaging and Video devices
  - Storage
  - Network Interfaces
  - Displays

Bus Based Architecture



- **Single address map**
- **Limited to a single processor or single bus owner at a time**
- **Difficulty scaling processing requirements with I/O needs**

LAN Based Architecture

- **Internet Protocol is a sophisticated protocol that is aimed at a complex problem:**

  Interconnect hundreds of thousands of computers

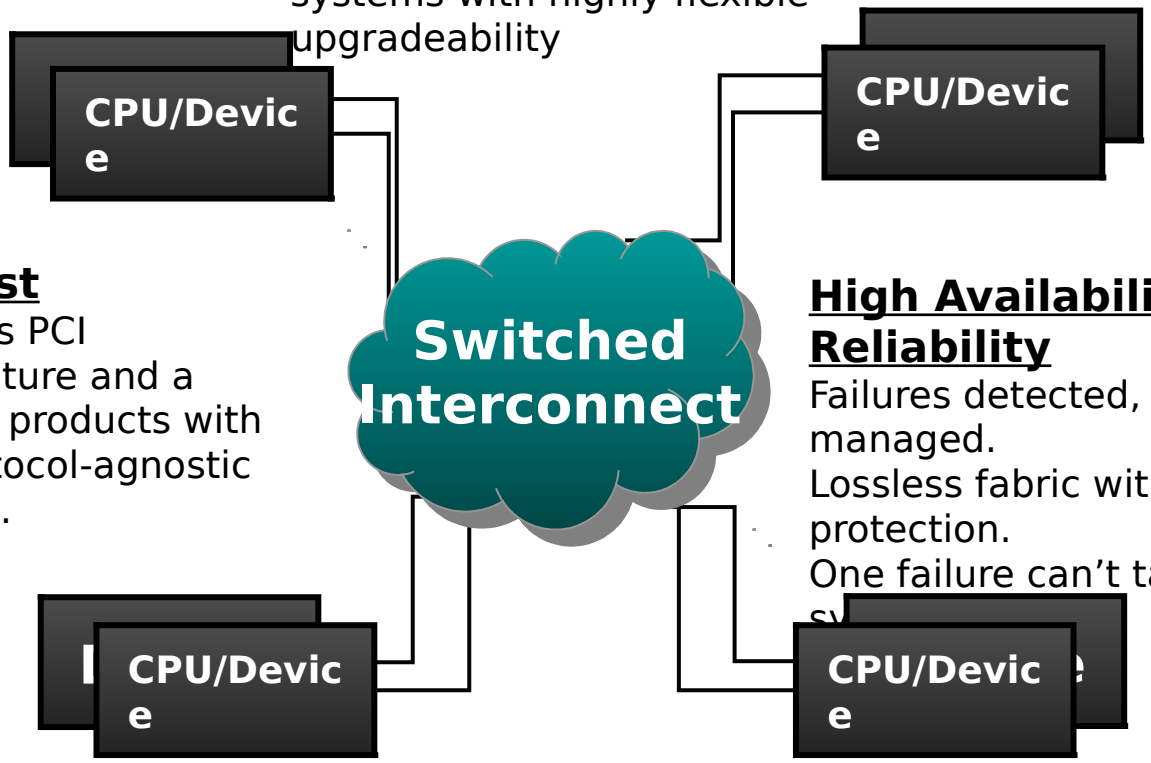
  - Handle extreme latencies
  - Handle lost packets
  - Handle corrupted packets
  - Handle out-of-order packet arrival

Limitations of Current Architectures

- **Difficulty balancing computational power with I/O requirements**
  - No support for **both** processor-to-processor and processor-to-device communication (Ethernet and bus architectures can do either but not both)
- **“Lossy” LAN transport do not meet lossless data collection requirements without additional software**
  - Ethernet will drop packets if congestion occurs
- **High latency or limited bandwidth scaling**
  - Moving a 64 bytes packet takes > 100 microseconds with Ethernet versus a couple of microseconds with a switch fabric
- **Limited Class of Service capability**
  - Ethernet has no separate queuing or buffering for CoS
  - Buses don’t have any CoS

Serial Switched Interconnects

Scalability, Density, Flexibility Supports "disaggregated" and "virtual" systems with highly flexible upgradeability



Low Cost
Leverages PCI infrastructure and a wealth of products with lean, protocol-agnostic switching.

High Availability & Reliability
Failures detected, reported & managed.
Lossless fabric with CRC protection.
One failure can't take down sy

High Performance Unified Fabric Multiple types and classes of traffic supported on low latency, high bandwidth interconnect.

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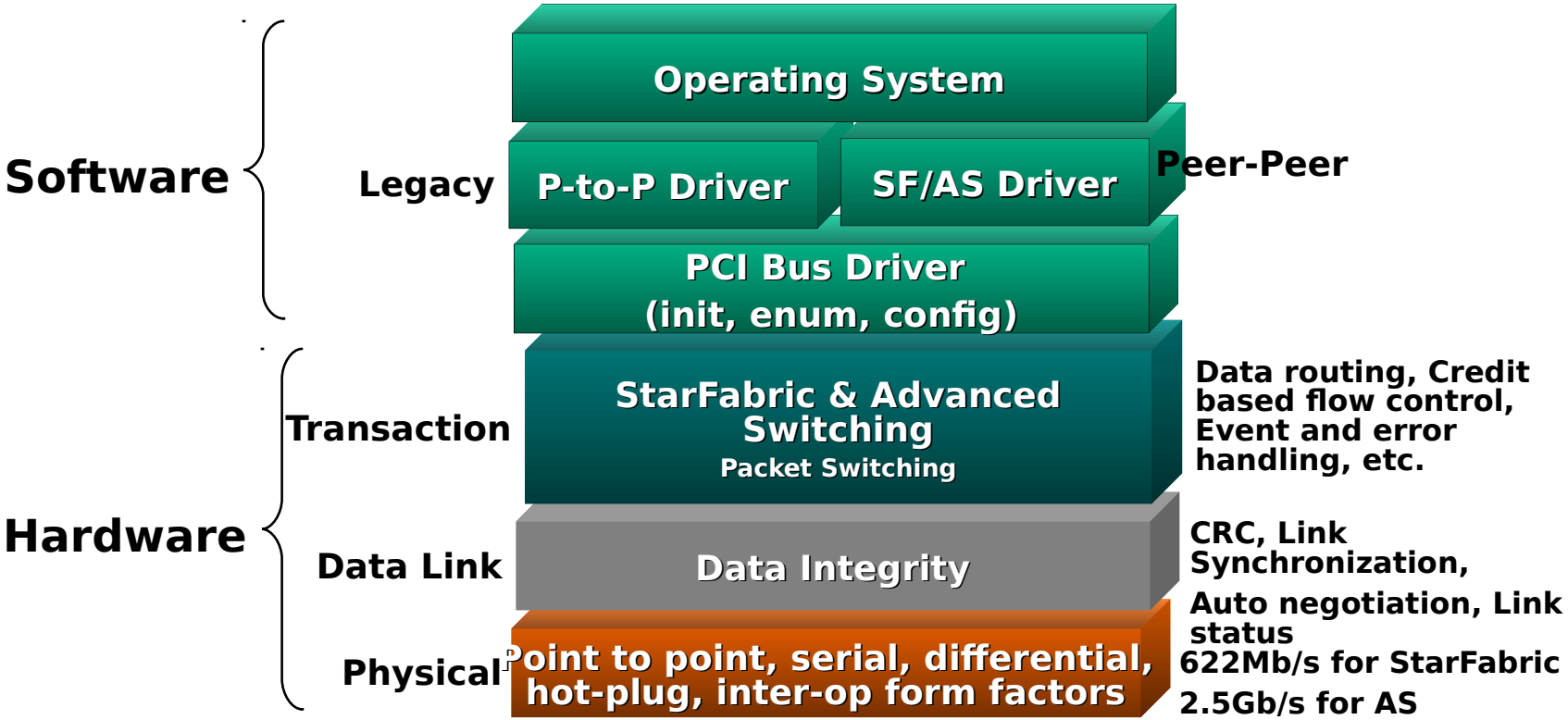
StarFabric & PCI Express Advanced Switching (AS)

- **Scalable, Extensible Serial Switched Interconnects**
  - Lean, High Performance, Low Cost Switching Architectures
  - Layered Approach Promotes Efficient Modularity

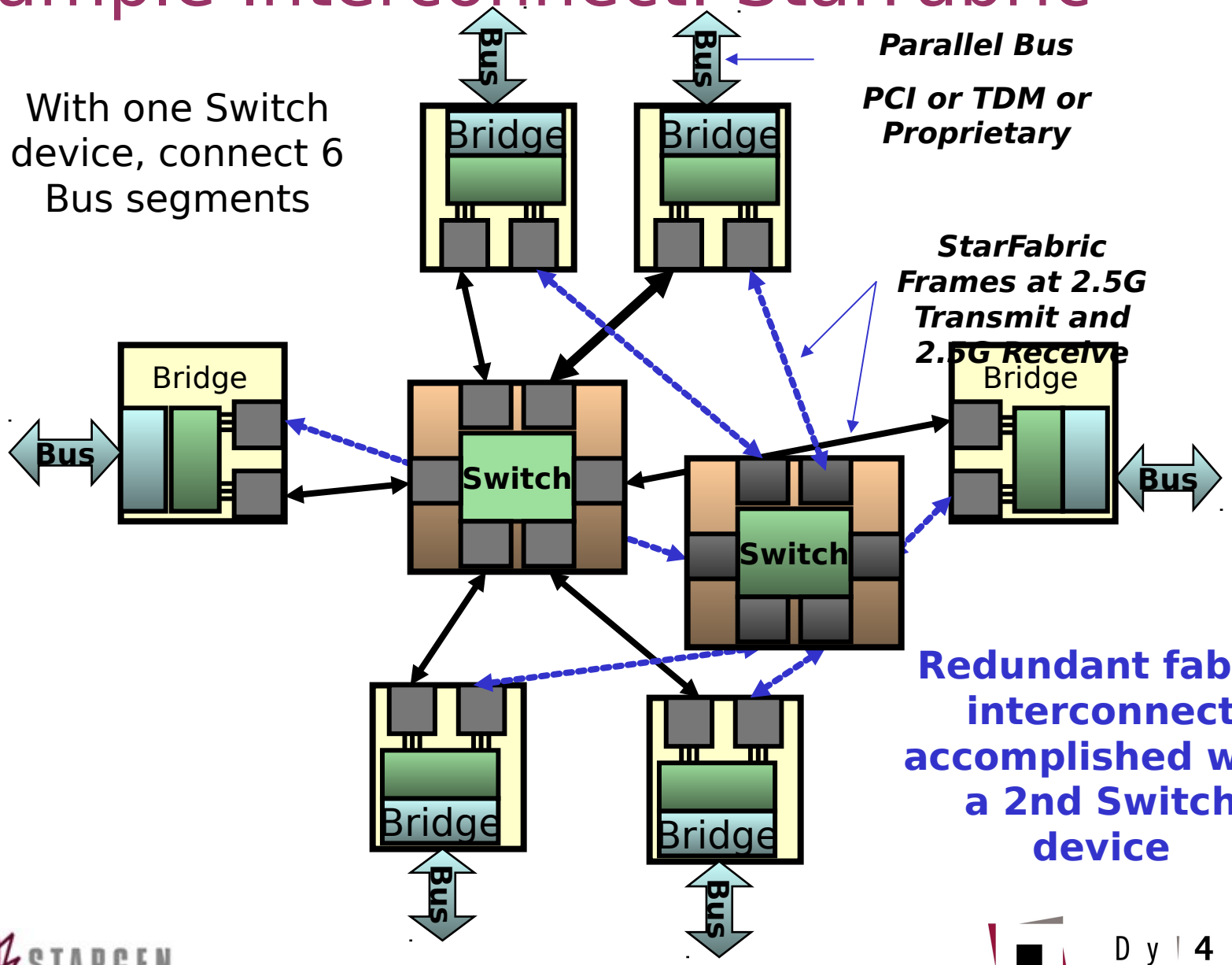
- **StarFabric**
  - Open standard switched interconnect (StarFabric Trade Association)
  - Based on 622Mb/s SERDES technology
    - 4X data bandwidth of 2 Gb/s
    - Links can extend beyond single chassis up to 10 meters through standard CAT5 cabling
  - In production since Spring 2002

- **PCI Express - Advanced Switching (AS)**
  - Based on the PCI Express™ architecture
  - Based on 2.5Gb/s SERDES technology
    - 4X data bandwidth of 8 Gb/s
  - Available in late 2004

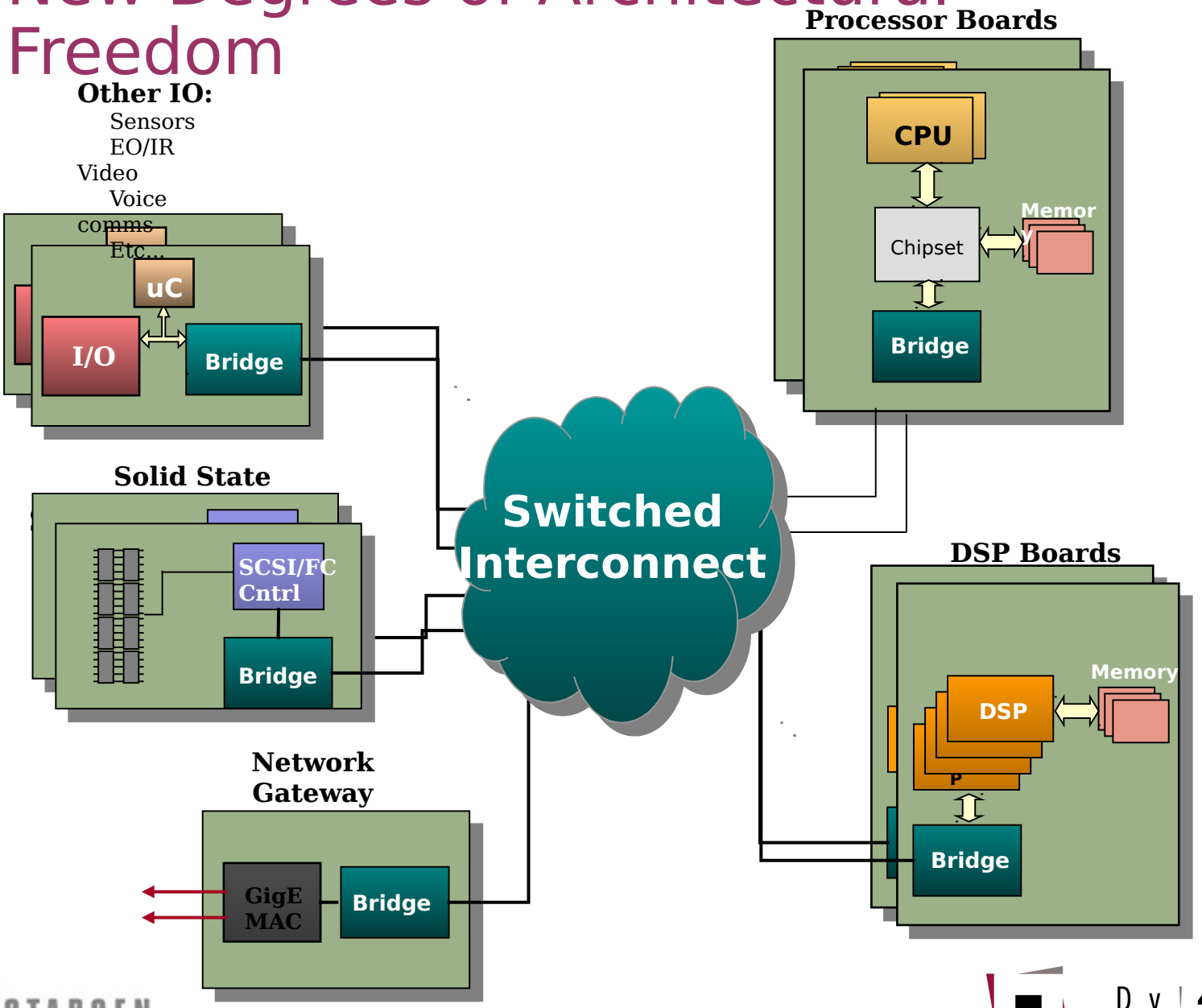
Multi-Layered Protocols



Example Interconnect: StarFabric


With one Switch device, connect 6 Bus segments
Parallel Bus
PCI or TDM or Proprietary
StarFabric Frames at 2.5G Transmit and 2.5G Receive
Bridge
Bus
Switch
Redundant fabric interconnect accomplished with a 2nd Switch device

New Degrees of Architectural Freedom



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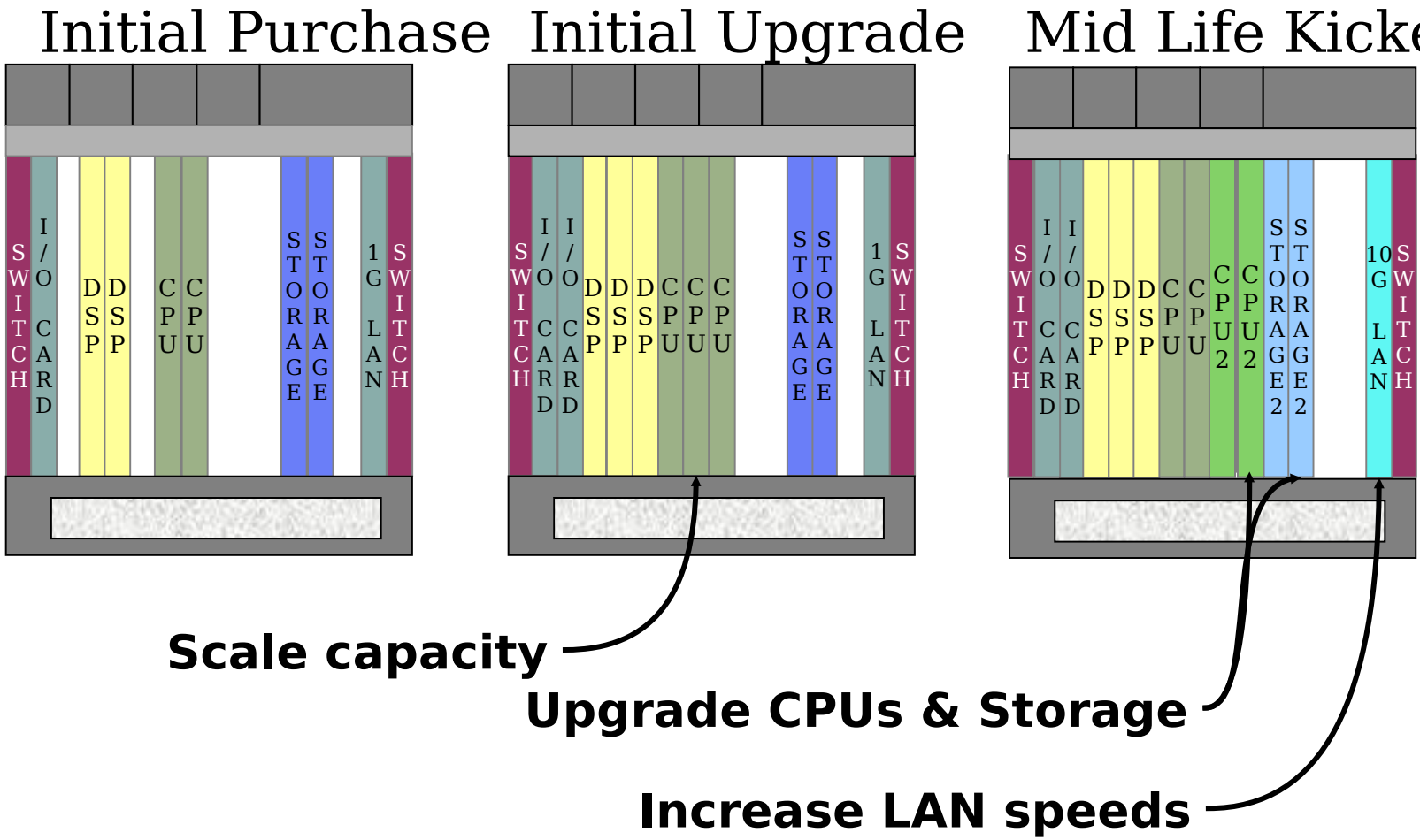
Adaptive Infrastructure
Life Cycle Benefits



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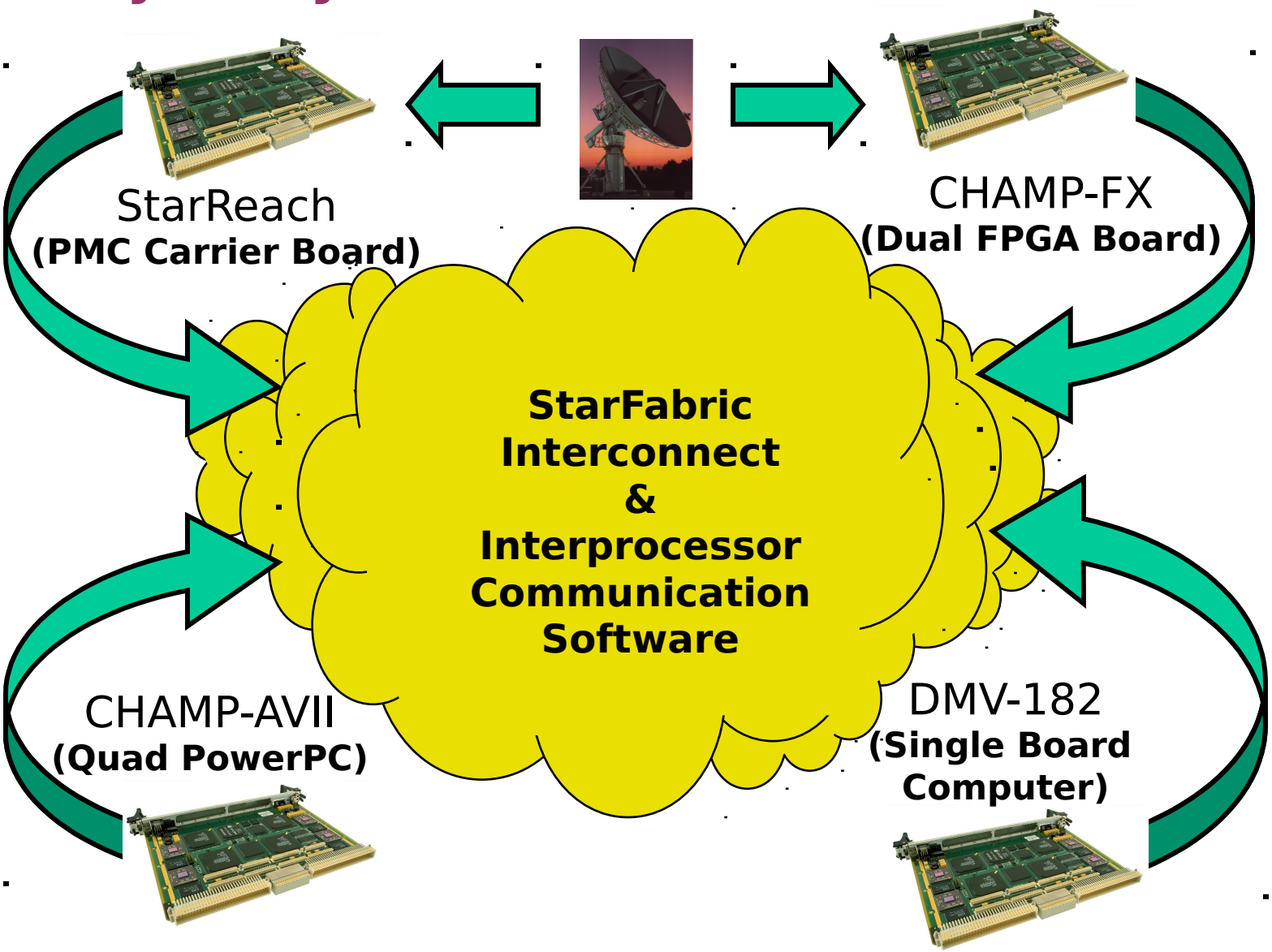
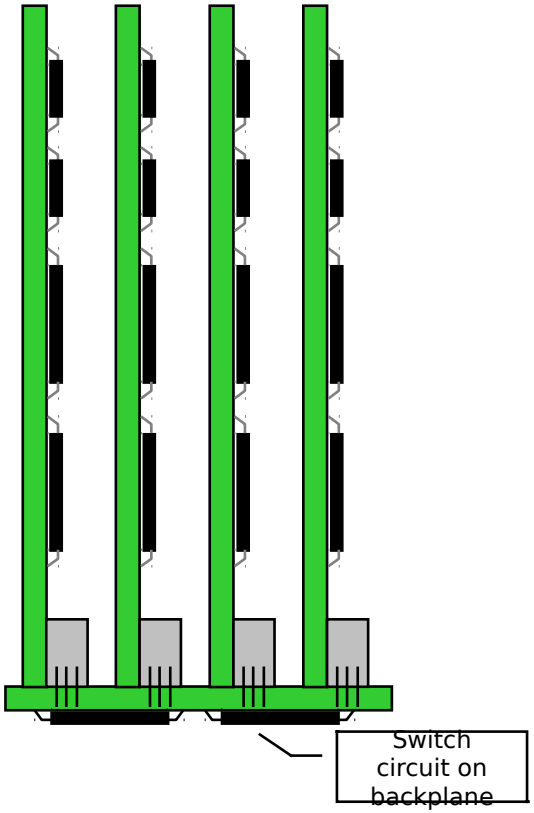
Dy 4 System Solutions



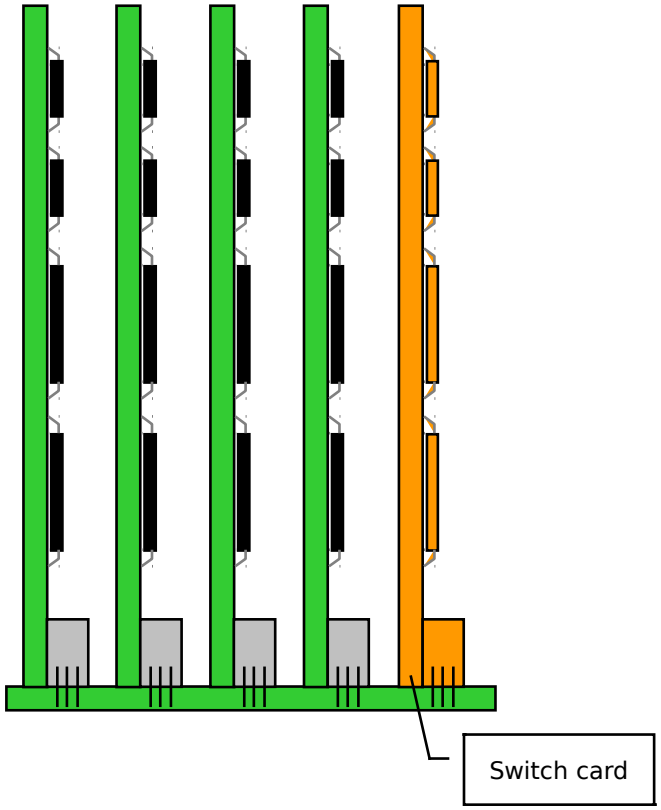
Advantages of Distributed Switching

Backplane switching



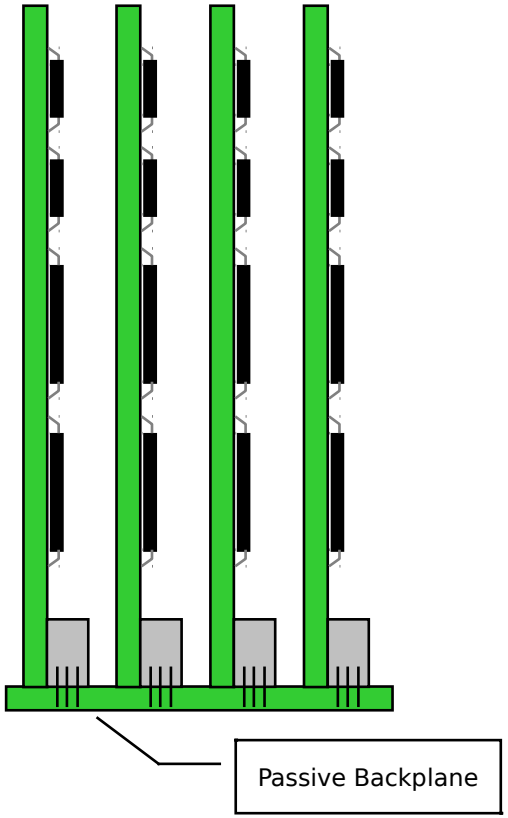
- √ ▪Four slots
- X ▪Active circuits on backplane

Separate Switch Card



- X ▪ Requires extra slot
- X ▪ Single point of failure
- X ▪ Extra LRU item logistics

StarFabric



- √ ▪Switching on card
- √ ▪No active backplane
- √ ▪Four slots used

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Summary

- **Switched Interconnects like StarFabric and PCI Express AS:**
  - Provide low cost, high performance interconnects for multislot, distributed architectures
  - Leverage the PCI/PCI-X infrastructure and volumes
  - Provide CPU-to-CPU and CPU-to-device communication
  - Reduces processor overhead and system latencies
  - Provides a reliable interconnect for multiple classes of service
  - Enables design flexibility and system disaggregation
  - Allows flexible fabric architecture, centralized or distributed switching

Thank You!

Contact information for follow up questions or discussions...

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